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| FORM PTO-1390 (Modified) (REV 10-95) | | U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE | ATTORNEY'S DOCKET NUMBER R.32491 |
| TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371 | | | U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR 09/308269 |
| INTERNATIONAL APPLICATION NO. PCT/DE 98/01892 | INTERNATIONAL FILING DATE 09 July 1998 | PRIORITY DATE CLAIMED 18 September 1997 | |
| TITLE OF INVENTION Device For Measuring The Mass Of A Flowing Medium | | | |
| APPLICANT(S) FOR DO/EO/US MULLER, Wolfgang REYMANN, Klaus KONZELMANN, Uwe | | | |
| Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information: | | | |
| <ol style="list-style-type: none"> 1. <input checked="" type="checkbox"/> This is a FIRST submission of items concerning a filing under 35 U.S.C. 371. 2. <input type="checkbox"/> This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371. 3. <input checked="" type="checkbox"/> This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1). 4. <input checked="" type="checkbox"/> A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date. 5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371 (c) (2)) <ol style="list-style-type: none"> a. <input checked="" type="checkbox"/> is transmitted herewith (required only if not transmitted by the International Bureau). b. <input type="checkbox"/> has been transmitted by the International Bureau. c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US). 6. <input checked="" type="checkbox"/> A translation of the International Application into English (35 U.S.C. 371(c)(2)). 7. <input type="checkbox"/> A copy of the International Search Report (PCT/ISA/210). 8. <input type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3)) <ol style="list-style-type: none"> a. <input type="checkbox"/> are transmitted herewith (required only if not transmitted by the International Bureau). b. <input type="checkbox"/> have been transmitted by the International Bureau. c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired. d. <input type="checkbox"/> have not been made and will not be made. 9. <input type="checkbox"/> A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)). 10. <input type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)). 11. <input type="checkbox"/> A copy of the International Preliminary Examination Report (PCT/IPEA/409). 12. <input type="checkbox"/> A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)). | | | |
| <p>Items 13 to 18 below concern document(s) or information included:</p> <ol style="list-style-type: none"> 13. <input type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98. 14. <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included. 15. <input checked="" type="checkbox"/> A FIRST preliminary amendment. A SECOND or SUBSEQUENT preliminary amendment. 16. <input type="checkbox"/> A substitute specification. 17. <input type="checkbox"/> A change of power of attorney and/or address letter. 18. <input type="checkbox"/> Certificate of Mailing by Express Mail 19. <input checked="" type="checkbox"/> Other items or information: | | | |
| <p>Transmittal Sheets in duplicate w/fees charged to Dep.Acct. 07-2100 Copy of German Text Application w/3 sheets drawings Translation of German Text Application w/3 sheets drawings Preliminary Amendment Copy of PCT/RO/101, PCT/ISA/210 and 220 Assignment to Robert Bosch GmbH (NOT ENCLOSED) Executed Declaration (NOT ENCLOSED)</p> | | | |

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| U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR | INTERNATIONAL APPLICATION NO. PCT/DE 98/01892 | ATTORNEY'S DOCKET NUMBER R.32491 |
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20. The following fees are submitted:

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :

☒ Search Report has been prepared by the EPO or JPO **\$930.00**

☐ International preliminary examination fee paid to USPTO (37 CFR 1.482) **\$720.00**

☐ No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) **\$790.00**

☐ Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO **\$1,070.00**

☐ International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) **\$98.00**

ENTER APPROPRIATE BASIC FEE AMOUNT =

Surcharge of **\$130.00** for furnishing the oath or declaration later than ☒ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).

| CLAIMS | NUMBER FILED | NUMBER EXTRA | RATE | |
|---|--------------|--------------|-----------|-----------------|
| Total claims | - 20 = | 0 | x \$22.00 | \$0.00 |
| Independent claims | - 3 = | 0 | x \$82.00 | \$0.00 |
| Multiple Dependent Claims (check if applicable). <input type="checkbox"/> | | | | \$0.00 |
| TOTAL OF ABOVE CALCULATIONS = | | | | \$970.00 |

Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28) (check if applicable). ☐ **\$0.00**

SUBTOTAL = \$970.00

Processing fee of **\$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (f)). **+** **\$0.00**

TOTAL NATIONAL FEE = \$970.00

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable). ☐ **\$0.00**

TOTAL FEES ENCLOSED = \$970.00

| | | |
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| | Amount to be: | |
| | refunded | \$ |
| | charged | \$ |

CALCULATIONS PTO USE ONLY

☐ A check in the amount of _____ to cover the above fees is enclosed.

☒ Please charge my Deposit Account No. **07-2100** in the amount of **\$970.00** to cover the above fees.
A duplicate copy of this sheet is enclosed.

☒ The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. **07-2100** A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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SIGNATURE _____

RONALD E. GREIGG

NAME _____

31,517

REGISTRATION NUMBER _____

May 17, 1999

DATE _____

09/308269

510 Recd PCT/PTO 17 MAY 1999

IN THE UNITED STATES AND TRADEMARK OFFICE

In re application of:

Wolfgang Mueller et al

Based on PCT/DE 98/01892

For: Device for Measuring the Mass of a Flowing Medium

PRELIMINARY AMENDMENT

Assistant Commissioner of Patents

Washington, D.C. 20231

Sir:

Prior to examination, please amend the above-identified application as follows:

IN THE SPECIFICATION

Page 1, line 4, delete "according to the preamble to claim 1".

Page 2, lines 22 and 23, delete ", with the characterizing features of claim 1".

Page 3, line 7, delete "in claim 1";

line 8, delete "in the dependent claims" and insert --hereinafter--.

Page 4, line 1, before "Drawings" insert --Brief Description of the--;

line 21, after "the" insert --electrical--.

Page 5, line 1, before "in" insert --to an outside electrical source--;

line 3, delete "it" and insert --the wall--.

Page 11, after line 6 insert the following:

--The foregoing relates to preferred exemplary embodiments of the invention, it being understood that other variants and embodiments thereof are possible within the spirit and scope of the invention, the latter being defined by the appended claims.--.

IN THE CLAIMS

Page 12, line 1, change "Claims" to --We Claim.--.

Cancel claims 1-9 and substitute claims 10-19.

10. A device for measuring the mass of a flowing medium, in an intake air mass of internal combustion engines, comprising a temperature-dependent measurement element that the flowing medium circulates around, said measurement element is disposed in a measurement conduit extending in the device from an inlet to an outlet, said measurement conduit is adjoined by a deflection conduit, wherein the measurement conduit has two faces that approach each other in a direction of the flow in the measurement conduit, the faces (37, 38) of the measurement conduit (30), which are disposed lateral to a surface (24) fixed by the measurement element (21), are embodied in an inclined fashion and approach each other in the flow direction (43) of the medium in the measurement conduit (30).

11. The device according to claim 10, in which the flow cross section of the measurement conduit (30) is rectangular and has

two faces (39, 40) extending parallel to the surface (24) of the measurement element (21).

12. The device according to claim 10, in which an inclination angle α respectively enclosed by the faces (37; 38) that approach each other and an axis (12) passing through the center of the measurement conduit (30) is approximately 8° .

13. The device according to claim 11, in which an inclination angle α respectively enclosed by the faces (37; 38) that approach each other and an axis (12) passing through the center of the measurement conduit (30) is approximately 8° .

14. The device according to claim 10, in which the measurement conduit (30) and the deflection conduit (31) are comprised of two attachable parts, a base part (45) and a cover part (46).

15. The device according to claim 10, in which an edge face (50) of a first part (51) of the deflection conduit (31) is embodied as inclined in relation to an axis (12) passing through the center of the measurement conduit (30).

16. The device according to claim 15, in which an inclination angle β enclosed by the edge face (50) and the axis (12) of the measurement conduit (30) lies in the range from approximately 30° to 60° .

17. The device according to claim 10, in which at least one opening (60) is provided in the deflection conduit (31), which produces a connection to the medium circulating around the device (1).

18. The device according to claim 14, in which the thickness of the wall of the base part (45) and the cover part (46) is constant in the vicinity of side faces (39, 40) that extend parallel to the surface (24) of the measurement element (21).

19. The device according to claim 14, in which recesses (48) are provided in the base part (45), at least in the vicinity of the measurement conduit (30), which produce a constant wall thickness of the faces (37, 38) of the measurement conduit (30).

IN THE ABSTRACT

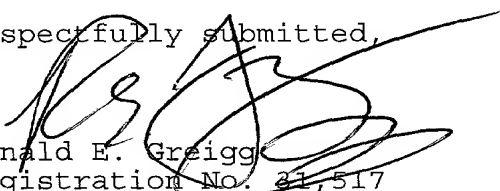
Please substitute the attached Abstract of the Disclosure for Abstract originally filed.

REMARKS

The above amendments are being made to place the application in better condition for examination.

Entry of the amendment is respectfully solicited.

Respectfully submitted,


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Abstract

A device for measuring the mass of a flowing medium with a temperature-dependent measurement element has a measurement conduit whose faces, which extend perpendicular to a surface fixed by the measurement element, are inclined and approach each other in the flow direction of the medium in the measurement conduit. The invention is provided for measuring the mass of a flowing medium to measure the intake air mass of internal combustion engines.

Device for Measuring the Mass of a Flowing Medium

Prior Art

5 The invention is based on a device for measuring the mass of a flowing medium according to the preamble to claim 1. A device has already been disclosed (DE-PS 44 07 209), which has a temperature-dependent measurement element that is accommodated in a measurement conduit that extends in a straight line. The measurement conduit extends in the device from an inlet to an outlet, which is adjoined by an S-shaped deflection conduit. The flowing medium flows from outside into the measurement conduit and then into the deflection conduit, where it flows out again from an outlet opening. The measurement conduit has a rectangular flow cross section, wherein two side faces oriented toward the platelet-shaped measurement element are embodied extending obliquely so that a tapering of the measurement conduit is produced in the flow direction of the medium in the measurement conduit. A top face of the measurement conduit, which extends lateral to the side faces and from which the measurement element protrudes, and a bottom face of the measurement conduit disposed opposite this top face thereby extend in a level or parallel fashion, with a constant distance from each other.

20 A device equipped with such a measurement conduit is also known from the SAE Paper 950433 (International Congress and Exposition Detroit, Michigan, February 27 - March 2, 1995, Reprinted from: Electronic Engine Controls 1995 (SP-1082)). As

can be inferred from the sectional depiction in the top picture in Fig. 7 on page 108, the measurement conduit and the deflection conduit are essentially comprised of two parts, wherein a part referred to below as the base part, with the measurement element, includes a side face, a top face, and a bottom face of the measurement conduit and the deflection conduit. The other part has only the second side face of the measurement conduit and the deflection conduit and thus constitutes a cover part. The base part and the cover part are preferably made of plastic, for example using the plastic injection molding technique. Because of the tapering shape of the side faces of the measurement conduit, an increasing wall thickness is produced in the flow direction. In the manufacturing, it has turned out that due to the increasing wall thickness, varying cooling speeds and accumulations of material occur, which can in particular lead to hollows in the side faces of the measurement conduit. In a provided mass production of the device, this results in more or less intense variations in the achievable measurement precision of the devices.

Advantages of the Invention

The device according to the invention for measuring the mass of a flowing medium, with the characterizing features of claim 1 has the advantage over the prior art that in mass production, devices with a properly manufactured housing can be produced so that only extremely slight variations in the measurement precision occur. It is also particularly advantageous that by

means of the embodiment, according to the invention, of the walls
of the measurement conduit, an acceleration of the flow in the
measurement conduit can furthermore be maintained, which leads
in a known manner to a stabilization of the flow of the medium
in the measurement conduit, particularly at the inlet.

Advantageous improvements and updates of the device
disclosed in claim 1 are possible by means of the measures taken
in the dependent claims.

An inclined embodiment of an edge face of the deflection
conduit is particularly advantageous, with which it is possible
to further simplify the manufacturing of the measurement conduit
and the deflection conduit, wherein a further improvement of the
measurement result also occurs.

Furthermore, a flow connection to the external flow in the
intake line is provided in the deflection conduit in the form of
an opening, by means of which possibly existing residual
interferences of a pressure wave in the deflection conduit can
be completely eliminated so that a further improvement of the
measurement result can be achieved. Furthermore, the device has
a considerably reduced measurement signal noise, which can be
produced by means of turbulences that occur in the measurement
conduit.

Drawings

Exemplary embodiments of the invention are shown in simplified form in the drawings and will be explained in more detail in the description that follows.

5 Fig. 1, in a partially sectional depiction, shows a side view of the device according to a first exemplary embodiment according to the invention,

Fig. 2 is a section through the device along a line II - II in Fig. 1,

10 Fig. 3, in a partially sectional depiction, shows a side view of the device according to a second exemplary embodiment according to the invention.

Description of the Exemplary Embodiments

15 In a partially sectional depiction, Fig. 1 shows a side view of a device labeled 1, which is used to measure the mass of a flowing medium, in particular the intake air mass of internal combustion engines. The internal combustion engine can be a mixture compressing engine with externally supplied ignition, or it can also be an air compressing, self-igniting engine. The
20 device 1 has, for example, a narrow, rod-like, block-shaped form that extends longitudinally in the direction of the plug axis 10, and is inserted into an opening let into a wall 8 of an intake

line 9, for example so that it can be plugged in. The device 1 is sealed by means of a sealing ring 3 in the wall 8, and is connected to it, for example by means of a screw connection that is not shown in detail. The cross-hatched wall 8 is part of the intake line 9 that is embodied for example as cylindrical, through which the internal combustion engine can aspirate air from the environment by way of an air filter that is not shown in detail. The wall 8 of the intake line 9 defines a flow cross section that in the case of the cylindrical intake line 9, for example, has a circular cross section in the center of which a center axis 11 extends in the axial direction, parallel to the wall 8, and this axis is oriented perpendicular to the plug axis 10. With a part referred to below as the measurement part 17, the device 1 protrudes into the flowing medium, wherein the measurement part 17 is disposed, for example, approximately in the vicinity of the center of the intake line 9.

The device 1 is composed, for example, in one piece out of the measurement part 17, a support part 18, and a securing part 19, and is preferably made of plastic using the plastic injection molding technique. A measurement element 21 is embodied for example in the form of a so-called micromechanical component and has a plate-shaped, silicon-based support body 20 with an etched-out, membrane-shaped sensor region with an extremely slight thickness and a number of likewise etched-out resistive films. These resistive films constitute at least one temperature-dependent measurement resistor and for example one heating resistor. Preferably, the heating resistor is disposed in the

center of the membrane and, with the aid of a temperature sensor,
is regulated to an overtemperature. Upstream and downstream of
the heating region constituted by the heating resistor, two
measurement resistors are disposed symmetrically to the heating
5 region. A measurement element of this kind is known from the SAE
Paper 950433 mentioned above, as well as from DE-OS 42 19 454,
wherein the disclosures of both documents are expressly intended
to be a component of the current patent application. The support
body 20 of the measurement element 21 is accommodated flush in
10 a recess in a plate-shaped mount comprised, for example, of
metal, and is secured there, for example, by means of adhesive.
The individual resistive films of the measurement element 21 are
electrically connected by means of connecting lines 26 that
extend inside the device 1 to an electronic evaluation circuit
15 27 depicted with dashed lines in Figs. 1 and 3, which includes,
for example, a bridge-like resistive measurement circuit. With
a plug connection 28 provided on the securing part 19, the
electrical signals produced by the evaluation circuit 27 can also
be supplied, for example, to another electronic control device
20 for evaluation.

As depicted in Figs. 1 and 2, the measurement part 17 of the
device 1 has a block-shaped form and a measurement conduit 30
that extends along a measurement conduit axis 12 that extends
centrally in the measurement conduit 30 from an inlet 32 with a
25 rectangular cross section to an outlet 33 that likewise has a
rectangular cross section. The device 1 is installed in the
intake line 9, preferably with the measurement conduit axis 12

parallel to the center axis 11. However, it is also possible to install the device 1 with an oblique installation position, rotated around the plug axis 10. In addition to or instead of the oblique installation position, it is also conceivable to install the device 1 in a tilted installation position, inclined around the center axis 11. The measurement conduit 30 transitions downstream into an S-shaped deflection conduit 31. The measurement conduit 30 is defined by a top face 37, which is farther from the center axis 11 and is disposed above in Figs. 1 and 3, and by a bottom face 38, which is closer to the center axis 11 and is disposed below in Figs. 1 and 3, as well as by two side faces 39, 40, wherein only one of the side faces extending parallel to the plane of the drawing is visible in Figs. 1 and 3, namely the side face 39. The top face 37 and the bottom face 38 extend toward each other in the direction 43 of the medium flowing in the measurement conduit 30 toward the measurement element 21, and end with a narrowest cross section at a narrowest point 36 at the outlet 33 of the measurement conduit 30, which at the same time represents an inlet 34 of the deflection conduit 31. The measurement element 21 with the resistive films has a surface 24 exposed to the flow 43 in the measurement conduit 30, which is flush with a surface 25 of the mount 23. The faces 37, 38 of the measurement conduit 30, which extend in a plane lateral to or essentially perpendicular to the surface 24 of the plate-shaped measurement element 21, thereby enclose an inclination angle α , which is preferably approx. 8° .

As shown in more detail in Fig. 2, a sectional depiction along a line II - II in Fig. 1, the two side faces 39 and 40 extend approximately parallel to the surface 24 of the measurement element 21. Consequently, an axial tapering of the measurement conduit 30 in the flow direction 43 is produced only by means of the faces 37, 38 that approach each other, wherein the measurement element 21 is preferably disposed slightly upstream of the narrowest point 36 of the measurement conduit 30. The tapering of the measurement conduit 30 provided in the flow direction 43 or the constant reduction of the flow cross section from the inlet 32 to the outlet 33 has the effect that an accelerated flow is produced in the vicinity of the measurement element 21, which produces a virtually uninterrupted, uniform parallel flow in the vicinity of the measurement element 21.

The inclined embodiment of the faces 37, 38 according to the invention, which extends perpendicular to the surface 24 of the measurement element 21, as shown in Fig. 2, produces a base part 45 that contains the side face 39 and the faces 37, 38 and a cover part 46 that is connected to the base part 45, for example in a detachable manner, wherein the thickness of the wall of the base part 45 is constant in the vicinity of the side face 39 and the thickness of the wall of the cover part 46 is constant in the vicinity of the side face 40. With the provided manufacture of the base part 45 and the cover part 46 by means of plastic injection molding, in addition to the simpler manufacture with the injection molding, the constant thickness of the walls in the vicinity of the side faces 39, 40 produces the advantage that a

uniform cooling speed can be set, which assures the maintenance of a precise flatness of the faces 39 and 40. As shown in Fig. 1, the base part 45 also has, for example, a number of channel-shaped recesses 48, which are provided at least on the edge region of the measurement part 17 and in which the cover part 46 can engage by means of projections in order, for example, to lock the cover part 46 onto the base part 45 in detent fashion. The shaping of the recesses 48, particularly in the vicinity of the tapered measurement conduit 30, permits the embodiment of a uniform wall thickness, which during manufacture leads to a uniform cooling speed so that hollows or distortions in the faces 37, 38 of the measurement conduit 30 can likewise be prevented.

A second exemplary embodiment according to the invention is shown in Fig. 3, in which all parts that are the same or have the same function are depicted with the same reference numerals as in Figs. 1 and 2. The device 1 shown in Fig. 3 has a deflection conduit 31 that is shaped in a slightly modified fashion in relation to Fig. 1 and whose edge face 50, which extends perpendicular to the plane of the drawing and belongs to a first part 51 of the deflection conduit 31 directly adjoining the measurement conduit 30, extends obliquely to the measurement conduit axis 12. Preferably, an inclination angle β that is enclosed by the measurement conduit axis 12 and the edge face 50 is approximately 45° . However, it is also possible to embody the edge face 50 with an inclination angle β that lies in a range from approx. 30° to 60° . The inclined edge face 50 is provided in order for the medium that flows from the outlet 33 of the

measurement conduit 30 into the first part 51 of the deflection conduit 31 to be diverted along the edge face 50 into a second part 52, without an abrupt flow increase at a step, as is the case in the device 1 according to Figs. 1 and 2.

5 In addition to a conduit contour that is easier to manufacture, the inclined embodiment of the edge face 50 advantageously also results in the fact that interferences in the flow coming from the outlet 33 of the measurement conduit 30, which can occur, for example, in the form of whorls or in the form of pressure waves, are reflected against the edge face 50. This time dependent and location dependent reflection of the interferences against the edge face 50 can almost completely prevent an influence of the electrical signal sent by the measurement element 21 due to interferences in the flow so that there is a precise measurement result of the measurement element 21. Moreover, further downstream of the edge face 50, an opening 60 can be provided in the deflection conduit 31, which, for example in the form of a bore in the base part 45, produces a connection of the flow in the deflection conduit 31 to the external flow in the intake line 9. It is also conceivable to provide this opening 60 only in the cover part 46. Naturally, there can also be a number of openings 60, for example in the base part 45 and/or in the cover part 46. By means of the at least one opening 60, the resonance chamber, which is embodied by the deflection conduit 31 and is for the outgoing pressure waves downstream of the outlet 33 of the measurement conduit 30, can be influenced in such a way that an attenuation of the

pressure waves reflected against the edge face 50 occurs by means of a pressure equalization. Through the size of the cross section of the at least one opening 60, the natural frequency of the resonance chamber can be tuned to the frequency of the outgoing pressure waves in such a way that there is a further improvement of the measurement value delivered by the measurement element 21.

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Claims

1. A device for measuring the mass of a flowing medium, in particular the intake air mass of internal combustion engines, with a temperature-dependent measurement element that the flowing medium circulates around, which is disposed in a measurement conduit extending in the device from an inlet to an outlet, which is adjoined by a deflection conduit, wherein the measurement conduit has two faces that approach each other in the direction of the flow in the measurement conduit, characterized in that the faces (37, 38) of the measurement conduit (30), which are disposed lateral to a surface (24) fixed by the measurement element (21), are embodied in an inclined fashion and approach each other in the flow direction (43) of the medium in the measurement conduit (30).

2. The device according to claim 1, characterized in that the flow cross section of the measurement conduit (30) is rectangular and has two faces (39, 40) extending parallel to the surface (24) of the measurement element (21).

3. The device according to claim 1 or 2, characterized in that an inclination angle α respectively enclosed by the faces (37; 38) that approach each other and an axis (12) passing through the center of the measurement conduit (30) is approximately 8° .

4. The device according to claim 1, characterized in that the measurement conduit (30) and the deflection conduit (31) are

comprised of two attachable parts, a base part (45) and a cover part (46).

5. The device according to claim 1, characterized in that an edge face (50) of a first part (51) of the deflection conduit (31) is embodied as inclined in relation to an axis (12) passing through the center of the measurement conduit (30).

6. The device according to claim 5, characterized in that an inclination angle β enclosed by the edge face (50) and the axis (12) of the measurement conduit (30) lies in the range from approximately 30° to 60° .

7. The device according to claim 1, characterized in that at least one opening (60) is provided in the deflection conduit (31), which produces a connection to the medium circulating around the device (1).

8. The device according to claim 4, characterized in that the thickness of the wall of the base part (45) and the cover part (46) is constant in the vicinity of side faces (39, 40) that extend parallel to the surface (24) of the measurement element (21).

9. The device according to claim 4, characterized in that recesses (48) are provided in the base part (45), at least in the vicinity of the measurement conduit (30), which produce a

constant wall thickness of the faces (37, 38) of the measurement conduit (30).

Abstract

Known devices for measuring the mass of a flowing medium with a temperature-dependent measurement element have a tapered measurement conduit with side faces that become steadily thicker
5 opposite from a surface of the measurement element. In the manufacturing of the measurement conduit, due to material accumulations, imprecisions can occur in the embodiment of the side faces, which produces a disadvantageous influence on the measurement result.

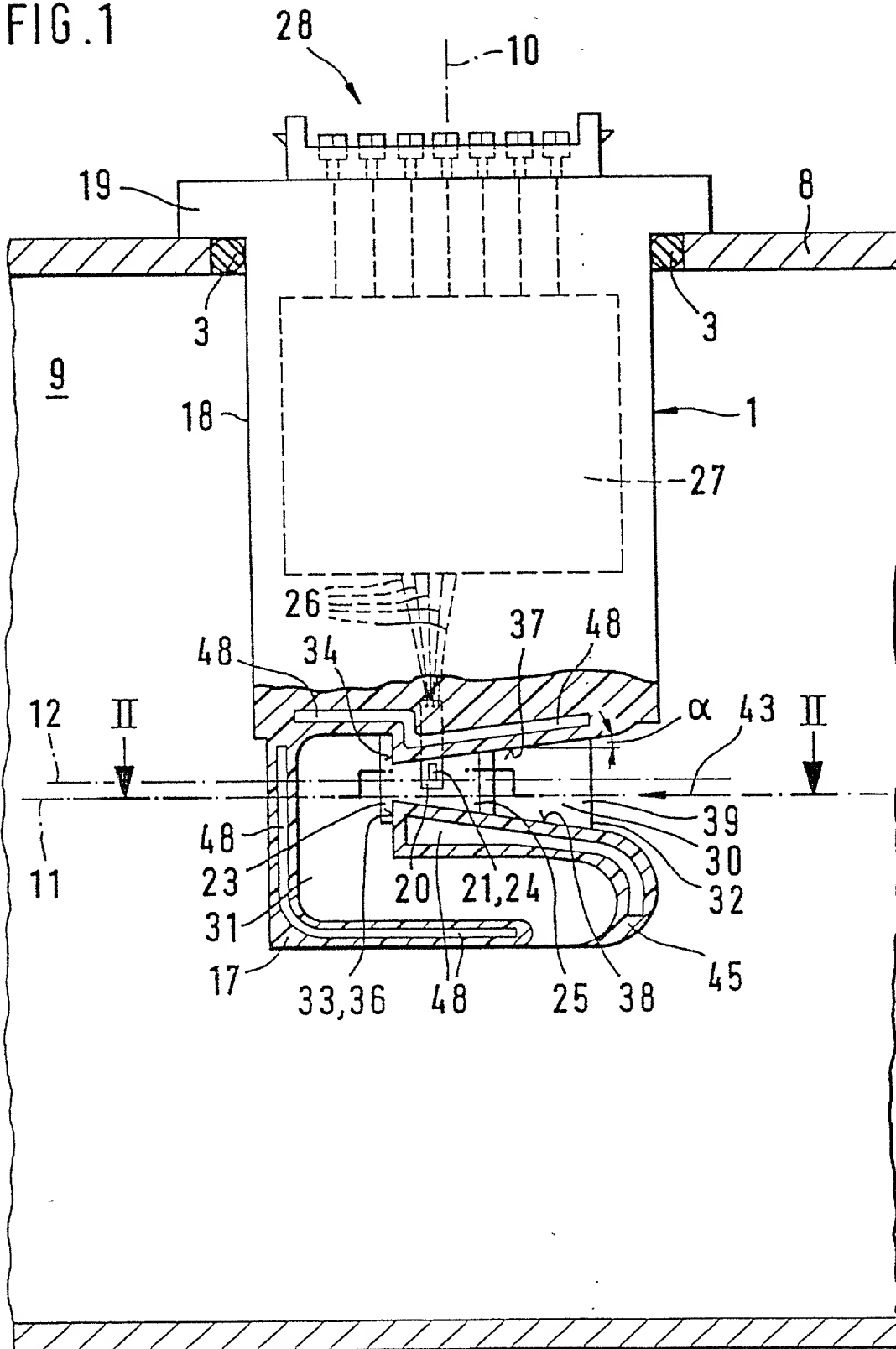
10 In order to produce a properly-manufactured housing, the device (1) has a measurement conduit (30) whose faces (37, 38), which extend perpendicular to a surface (24) fixed by the measurement element (21), are inclined and approach each other
15 in the flow direction (43) of the medium in the measurement conduit (30).

The invention is provided for measuring the mass of a flowing medium, in particular to measure the intake air mass of internal combustion engines.

(Fig. 1)

1 / 3

FIG. 1



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FIG. 2

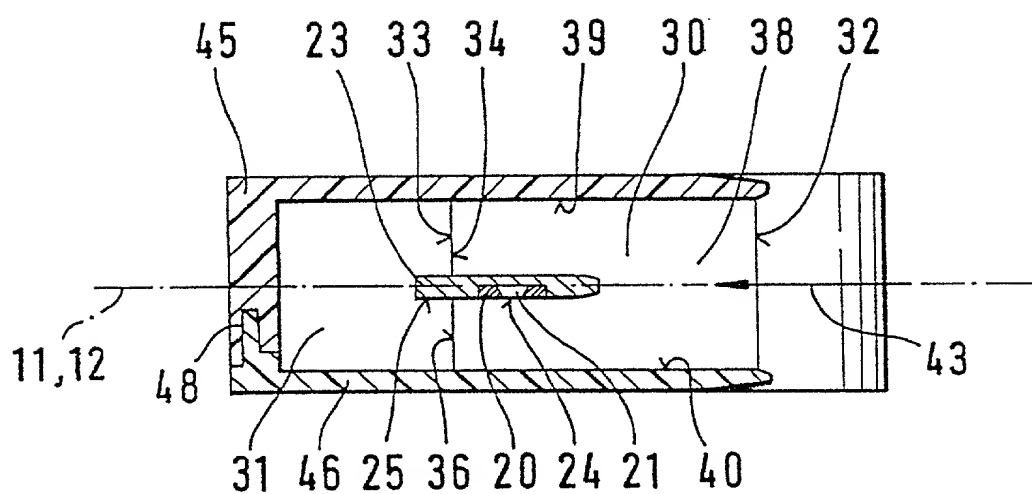
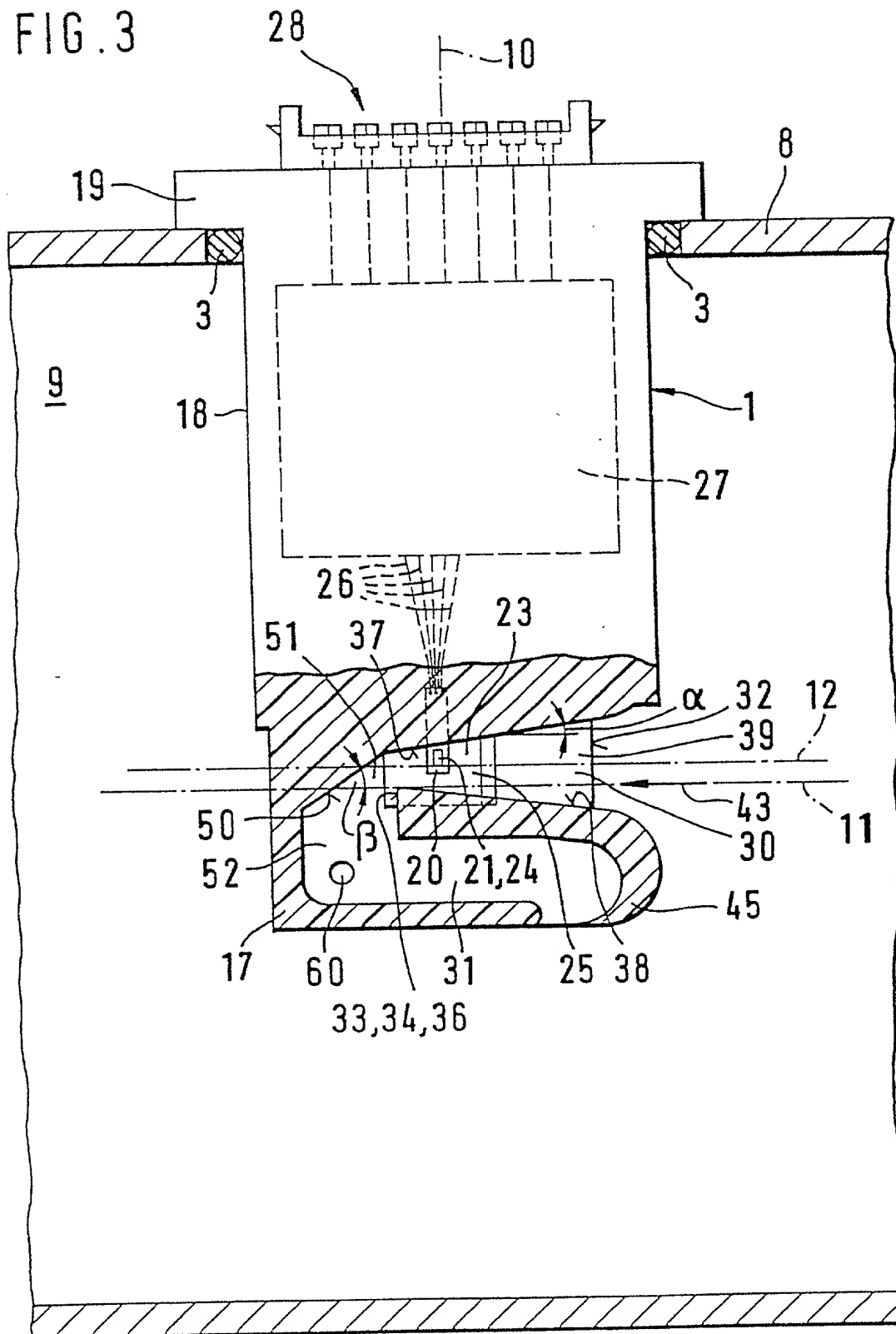


FIG. 3



Express Mail Label No.

Page 1 of

Docket No.

R.32491

Declaration and Power of Attorney For Patent Application

English Language Declaration

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

DEVICE FOR MEASURING THE MASS OF A FLOWING MEDIUM

the specification of which

(check one)

☐ is attached hereto.

☒ was filed on 09 July 1998 as United States Application No. or PCT International Application Number PCT/DE 98/01892 and was amended on _____

(if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d) or Section 365(b) of any foreign application(s) for patent or inventor's certificate, or Section 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)

Priority Not Claimed

| | | | | |
|----------------------|----------------|--------------------------|-------------------------------------|--------------------------|
| <u>1 97 41 031.6</u> | <u>Germany</u> | <u>18 September 1997</u> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| (Number) | (Country) | (Day/Month/Year Filed) | | |
| _____ | _____ | _____ | <input type="checkbox"/> | |
| (Number) | (Country) | (Day/Month/Year Filed) | | |
| _____ | _____ | _____ | <input type="checkbox"/> | |
| (Number) | (Country) | (Day/Month/Year Filed) | | |

I hereby claim the benefit under 35 U.S.C. Section 119(e) of any United States provisional application(s) listed below:

(Application Serial No.)

(Filing Date)

(Application Serial No.)

(Filing Date)

(Application Serial No.)

(Filing Date)

I hereby claim the benefit under 35 U. S. C. Section 120 of any United States application(s), or Section 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. Section 112, I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, C. F. R., Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

(Application Serial No.)

(Filing Date)

(Status)
(patented, pending, abandoned)

(Application Serial No.)

(Filing Date)

(Status)
(patented, pending, abandoned)

(Application Serial No.)

(Filing Date)

(Status)
(patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (list name and registration number)

Edwin E. Greigg - Reg. No. 15,785

Ronald E. Greigg - Reg. No. 31,517

2

Send Correspondence to: Ronald E. Greigg
Two Skyline Place
5203 Leesburg Pike #600
Falls Church, VA 22041

Direct Telephone Calls to: (name and telephone number)

Ronald E. Greigg - Telephone: (703) 575-3400 Facsimile: (703) 892-0303

| | |
|-------------------------------------|---|
| Full name of sole or first inventor | <u>Wolfgang MULLER</u> |
| Sole or first inventor's signature | <u>Wolfgang Muller</u> Date <u>31.05.99</u> |
| Residence | <u>D-71277 Rutesheim, Germany</u> DET |
| Citizenship | <u>Deutsch</u> |
| Post Office Address | <u>Renninger Str. 3/2,</u> |
| | <u>D-71277 Rutesheim, Germany</u> |

| | |
|--------------------------------------|---|
| Full name of second inventor, if any | <u>Klaus REYMANN</u> |
| Second inventor's signature | <u>Klaus Reymann</u> Date <u>01.06.99</u> |
| Residence | <u>D-70839 Gerlingen, Germany</u> DET |
| Citizenship | <u>Deutsch</u> |
| Post Office Address | <u>Robert-Koch-Str. 50,</u> |
| | <u>D-70839 Gerlingen, Germany</u> |

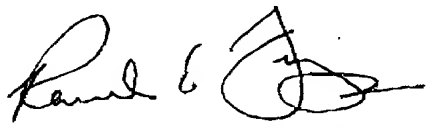
300

| | |
|---|----------|
| Full name of third inventor, if any Uwe KONZELMANN | Date |
| Third inventor's signature Uwe Konzelmann | 31.05.99 |
| Residence D-71679 Asperg, Germany | |
| Citizenship Deutsch | |
| Post Office Address Schwalbenweg 14, | |
| D-71679 Asperg, Germany | |

| | |
|--------------------------------------|------|
| Full name of fourth inventor, if any | Date |
| Fourth inventor's signature | |
| Residence | |
| Citizenship | |
| Post Office Address | |

| | |
|-------------------------------------|------|
| Full name of fifth inventor, if any | Date |
| Fifth inventor's signature | |
| Residence | |
| Citizenship | |
| Post Office Address | |

| | |
|-------------------------------------|------|
| Full name of sixth inventor, if any | Date |
| Sixth inventor's signature | |
| Residence | |
| Citizenship | |
| Post Office Address | |

| | | | |
|--|--------------------|---|-------------------------------|
| Change Of Attorney Or Agent's Address In Application (37 CFR 1.8(a)) | | | Docket No. R. 32491 |
| In Re Application Of: Muller, Wolfgang et al | | | |
| Serial No. 09/308,269 | Filing Date | Examiner | Group Art Unit |
| Invention: Device For Measuring The Mass Of A Flowing Medium | | | |
| <u>TO THE ASSISTANT COMMISSIONER FOR PATENTS</u> | | | |
| Please send all correspondence for this application to: | | | |
| Ronald E. Greigg Greigg & Greigg P.L.L.C. 1423 Powhatan Street, Unit One Alexandria, Virginia 22314 | | | |
| Please direct all telephone calls to: | | | |
| | | Telephone: (703) 838-5500 | |
| | | Facsimile: (703) 838-5554 | |
|  | | Dated: August 28, 2000 | |
| <i>Signature of Attorney or Agent of Record</i> | | | |
| <div style="border: 1px solid black; padding: 5px;">Ronald E. Greigg Registration No. 31,517 1423 Powhatan Street, Unit One Alexandria, Virginia 22314 Telephone: (703) 838-5500 Facsimile: (703) 838-5554 <i>Registration Number & Address of Attorney or Agent of Record</i></div> | | <div style="border: 1px solid black; padding: 5px;">I certify that this document is being deposited on with the U.S. Postal Service as first class mail under 37 C.F.R. 1.8 and is addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231. <i>Signature of Person Mailing Correspondence</i> <i>Typed or Printed Name of Person Mailing Correspondence</i></div> | |

#4

GREIGG & GREIGG P.L.L.C.
A Professional Limited Liability Company
Unit One Station Square, 1423 Powhatan Street
Alexandria, Virginia 22314 U. S. A.

Ronald E. Greigg*

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Edwin E. Greigg

of Counsel
James L. Bean

703-838-5500
703-838-5554 (fax)
e-mail: rgreigg@greigg.com
www.lawyers.com/patattly

FACSIMILE TRANSMISSION SHEET

RECEIVED

11 JUL 2001

Legal Unit
International Division

Date: June 18, 2001
To: Catherine Short
From: Judy Atkins / Greigg & Greigg
Re: Muller / 09 / 308,269

No. of pages to follow 15

Comments: Ms. Short
per our conversation

of today -Judy Atkins(703)-838-5500

The information in this facsimile transmission is intended only for the personal and confidential use of the designated recipients named above. This message may be an attorney-client communication and as such is privileged. If the reader of this message is not the intended recipient named above, you are notified that you have received this document in error and any review, dissemination, distribution or copying of this message is strictly prohibited. If you have received this document in error, please notify this office immediately by telephone and return the original message to the above address by mail.

* D.C. Bar
Florida Bar
• Maryland Bar

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

Wolfgang Muller et al

Serial No. 09/308,269

Attention:

Filed:

Ms. Catherine Short

Based on PCT/DE 98/01892

For: DEVICE FOR MEASURING THE MASS
OF A FLOWING MEDIUM

RESPONSE TO WITHDRAW NOTICE OF ABANDONMENT

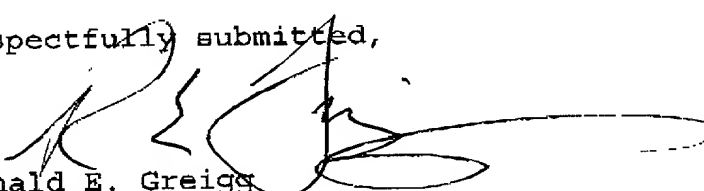
Assistant Commissioner for Patents
Box PCT
Washington, D.C. 20231

Sir:

In response to a telephone conversation with Ms. Catherine Short, please find enclosed the Response to Notification of Abandonment and enclosures, which were faxed to PCT Division on August 29, 2000, to the attention of Ms. Pat Booker. Apparently, these documents were never received and have not been entered into the file. Please review the following documentation, which was timely filed on July 8, 1999 and forwarded via facsimile on August 29, 2000.

It is hereby requested that the Notice of Abandonment be withdrawn and this application forwarded to the appropriate group for further action.

Respectfully submitted,


Ronald E. Greigg
Registration No. 31,517
Attorney for ApplicantsGreigg & Greigg P.L.L.C.
1423 Powhatan Street, Unit One
Alexandria, VA 22314Telephone: (703) 838-5500
Facsimile: (703) 838-5554

Customer No. 002119

09308269-070801

GREIGG & GREIGG P.L.L.C.
A Professional Limited Liability Company
Unit One Station Square, 1423 Powhatan Street
Alexandria, Virginia 22314 U. S. A.

faxed per JA

Ronald E. Greigg#

Parent Agent
Melvin L. Crane

Counsel
Edwin E. Greigg

of Counsel
James L. Bean
William H. Holt

703-838-5500
703-838-5554 (fax)
e-mail: rgreigg@ricochet.net
www.lawyers.com/patatty

FACSIMILE TRANSMISSION SHEET

Date: Aug. 29, 2000
To: Pat Booker / RT
From: Judy Atkins (703) 838-5500
Re: Serial No. 09/308, 269
Muller et al

No. of pages to follow 13Comments: Ms. Booker,

Please find following a Response
to Notice of Abandonment, including copies of all
previous responses, etc. Please call me if you need
anything further.

Judy Atkins

The information in this facsimile transmission is intended only for the personal and confidential use of the designated recipients named above. This message may be an attorney-client communication and as such is privileged. If the reader of this message is not the intended recipient named above, you are notified that you have received this document in error and any review, dissemination, distribution or copying of this message is strictly prohibited. If you have received this document in error, please notify this office immediately by telephone and return the original message to the above address by mail.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

Wolfgang MULLER et al

Serial No. 09/308,269

Attention:
Pat Booker

Based on PCT/DE 98/01892

For: DEVICE FOR MEASURING THE
MASS OF A FLOWING MEDIUM

RESPONSE TO NOTIFICATION OF ABANDONMENT

Assistant Commissioner for Patents
Box PCT
Washington, D.C. 20231

Sir:

In response to the Notice of Abandonment dated June 9, 2000, please find attached copies of the documents which were filed in Response to the Notice of Missing Requirements dated July 2, 1999. A copy of our date-stamped receipt card is also attached which indicates the date of July 8, 1999.

- 1) Copy of PCT/DO/EO/909 dated June 9, 2000
- 2) Copy of PCT/DO/EO/905 dated July 2, 1999
- 3) Copy of Date-Stamped Receipt Card
- 4) Copy of Response to Missing Requirements dated July 8, 1999
- 5) Assignment to Robert Bosch GmbH
- 6) Executed Declaration
- 7) Change of Address (effective 01/01/00)

The Commissioner is hereby authorized to charge payment of any fees associated with this communication to Deposit Account 07-2100.

Respectfully submitted,



Ronald E. Greigg
Registration No. 31,517
Attorney for Applicants

Greigg & Greigg, P.L.L.C.
1423 Powhatan Street
Unit One
Alexandria, Virginia 22314
Telephone: (703) 838-5500
Facsimile: (703) 838-5554
28 August

09308269-070801



UNITED STATES DEPARTMENT OF COMMERCE
 Patent and Trademark Office
 Address: ASSISTANT COMMISSIONER FOR PATENTS
 Box PCT
 Washington, D.C. 20231

09/308269

| | | |
|------------------------------------|---------------------------------|-------------------------------|
| U.S. APPLICATION NO. 09/308,269 | FIRST NAMED APPLICANT MILLER | ATTY. DOCKET NO. U R 32494 |
| INTERNATIONAL APPLICATION NO. | | |
| PCT/DE98/01892 | | |
| IA FILING DATE | PRIORITY DATE | |
| 07/09/98 | 09/18/97 | |
| DATE MAILED | 06/09/00 | |

5611

RONALD E GREIG
 TWO SKYLINE PLACE
 5200 LEESBURG PIKE ANN
 FALLS CHURCH VA 22041

NOTIFICATION OF ABANDONMENT

The United States Patent and Trademark Office in its capacity as

☒ a Designated Office (37 CFR 1.494), ☐ an Elected Office (37 CFR 1.495), has made the following determination:

- ☐ Applicant's letter of express abandonment received _____, is in compliance with CFR 1.138 and is hereby acknowledged.
- ☐ Applicant has failed to provide the full U.S. Basic National Fee by ☐ 20 months (37 CFR 1.494(b)(2)), ☐ 30 months (37 CFR 1.495(b)(2)).
- ☐ Applicant has failed to respond to the notification of MISSING REQUIREMENTS (Form PCT/DO/EO/905), mailed _____ within the time period set therein.
- ☒ Applicant has failed to properly respond to the notification of MISSING REQUIREMENTS (Form PCT/DO/EO/905), mailed *02 July 1999* within the time period set therein. See the attached NOTIFICATION OF DEFECTIVE RESPONSE (Form PCT/DO/EO/916).
- ☐ Other.

Therefore, the above identified application failed to meet the requirements of 35 U.S.C 371 and 37 CFR ☐ 1.494, ☐ 1.495 and is ABANDONED AS TO THE UNITED STATES OF AMERICA.

PAT BOOKER, PARALEGAL

Telephone: (703)305-3738

FORM PCT/DO/EO/909 (May 1993)

RECEIVED

09308269-070801



UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark
Address: ASSISTANT COMMISSIONER FOR PATENTS
Box PCT
Washington, D.C. 20231

09/308269

U.S. APPLICATION NO.

09/308,269

MULLER

FIRST NAMED APPLICANT

ATTY. DOCKET NO.

W

R.32491

INTERNATIONAL APPLICATION NO.

PCT/DE98/01892

U.S. FILING DATE

PRIORITY DATE

07/03/98

09/18/97

DATE MAILED

07/02/99

NOTIFICATION OF MISSING REQUIREMENTS UNDER 35 U.S.C. 371 IN THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US)

1. The following items have been submitted by the applicant or the TB to the United States Patent and Trademark Office as ☒ a Designated Office (37 CFR 1.494), ☐ an Elected Office (37 CFR 1.495):

☒ U.S. Basic National Fee.

☒ Copy of the international application in:

☒ a Non-English language.

☐ English.

☒ Translation of the international application into English.

☐ Oath or Declaration of Inventor(s) for DO/EO/US.

☐ Copy of Article 19 amendments

☐ Translation of Article 19 amendments into English.

☐ The International Preliminary Examination Report in English and its Annexes, if any.

☐ Translation of Annexes to the International Preliminary Examination Report into English.

☒ Preliminary amendment(s) filed 12 May 99 and

☐ Information Disclosure Statement(s) filed and

☐ Assignment document.

☐ Power of Attorney and/or Change of Address.

☐ Substitute specification filed

☐ Statement Claiming Small Entity Status.

☒ Priority Document.

☒ Copy of the International Search Report ☒ and copies of the references cited therein.

☐ Other:

2. The following items **MUST** be furnished within the period set forth below in order to complete the requirements for acceptance under 35 U.S.C. 371:

☐ a. Translation of the application into English. Note a processing fee will be required if submitted later than the appropriate 20 or 30 months from the priority date.

☐ The current translation is defective for the reasons indicated on the attached Notice of Defective Translation.

☐ b. Processing fee for providing the translation of the application and/or the Annexes later than the appropriate 20 or 30 months from the priority date (37 CFR 1.492(f)).

☒ c. Oath or declaration of the inventors, in compliance with 37 CFR 1.497(a) and (b), identifying the application by the international application number and international filing date.

☐ The current oath or declaration does not comply with 37 CFR 1.497(a) and (b) for the reasons indicated on the attached PCT/DO/EO/917.

☐ d. Surcharge for providing the oath or declaration later than the appropriate 20 or 30 months from the priority date (37 CFR 1.492(e)).

3. Additional claim fees of \$ as a ☐ large entity ☐ small entity, including any required multiple dependent claim fee, are required. Applicant must submit the additional claim fees or cancel the additional claims for which fees are due (37 CFR 1.492(g)). See attached PTO-875.

ALL OF THE ITEMS SET FORTH IN 2(a)-2(d) AND 3 ABOVE MUST BE SUBMITTED WITHIN ONE MONTH FROM THE DATE OF THIS NOTICE OR BY ☐ 21 OR ☐ 31 MONTHS FROM THE PRIORITY DATE FOR THE APPLICATION, WHICHEVER IS LATER. FAILURE TO PROPERLY RESPOND WILL RESULT IN ABANDONMENT.

The time period set above may be extended by filing a petition and fee for extension of time under the provisions of 37 CFR 1.136(a).

4. Translation of the Annexes **MUST** be submitted no later than the time period set above or the annexes will be cancelled. Note processing fee will be required if submitted later than 30 months from the priority date.

5. ☐ The Article 19 amendments are cancelled since a translation was not provided by the appropriate 20 (37 CFR 1.494(d)) or 30 (37 CFR 1.495(d)) months from the priority date.

Applicant is reminded that any communication to the United States Patent and Trademark Office must be mailed to the address given in the heading and include the U.S. application no. shown above (37 CFR 1.5)

A copy of this notice MUST be returned with this response.

Enclosed: ☐ PCT/DO/EO/917 ☐ Notice of Defective Translation
☐ PTO-875

FORM PCT/DO/EO/905 (December 1997)

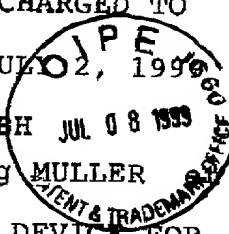
Telephone: (703) 305-3853
(703) 305-3853

RECEIVED

JUL 07 1999

09/308269 070001

13
PLEASE ACKNOWLEDGE RECEIPT OF: REPSONSE TO
MISSING REQUIREMENTS UNDER 35 USC 371
-RESPONSE IN DUPLICATE W/FEEs CHARGED TO
DEP.ACCT. 07-2100
-COPY OF PCT/DO/EO/905 DATED JULY 02, 1999
-EXECUTED DECLARATION
-ASSIGNMENT TO ROBERT BOSCH GMBH JUL 08 1999
IN RE APPLICATION OF: Wolfgang MULLER al
SERIAL NO. 09/308,269
BASED ON PCT/DE 98/01892 FOR: DEVICE FOR
MEASURING THE MASS OF A FLOWING MEDIUM
ATTENTION: SHELBY VIGIL July 8, 1999
REG/ja



09308269-070001

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

Wolfgang MULLER et al

Serial No. 09/308,269

Filed:

Attention:
Shelby Vigil
PCT INTERNATIONAL
DIVISION

Based on PCT/DE 98/01892

For: Device For Measuring The Mass
Of A Flowing Medium

RESPONSE TO MISSING REQUIREMENTS UNDER 35 USC 371

Assistant Commissioner for Patents
Box PCT
Washington, D.C. 20231

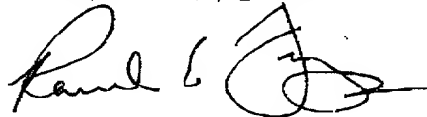
Sir:

In response to the Notice of Missing Requirements Under 35
U.S.C. 371 dated July 2, 1999, please find enclosed:

- 1) Copy of PCT/DO/EO/905 dated July 2, 1999
- 2) Executed Declaration
- 3) Assignment to Robert Bosch GmbH

The Commissioner is hereby authorized to charge payment of
any fees associated with this communication to Deposit Account
07-2100.

Respectfully submitted,

Ronald E. Greigg
Registration No. 31,517
Attorney for ApplicantsTwo Skyline Place
5203 Leesburg Pike #600
Falls Church, Virginia 22041Telephone: (703) 575-3400
Facsimile: (703) 892-0303

July 8, 1999

09308269-070801

Assignment of Rights, Title and Interest in Invention
(Multiple inventors; single assignee)Docket No.
R.32491*This is an Assignment of the following rights, title and interest: (check all that apply):*☒ *United States of America rights, title and interest in the invention*☐ *Foreign rights, title and interest in the invention*☒ *United States Patent Application Serial No.* _____*Date of Execution:* _____ *Date of Filing:* _____☐ *United States Provisional Patent Application Serial No.* _____☐ *United States Patent No(s).* _____☐ *International (PCT) Patent Application Serial No.* _____☐ *Other (specify)* _____**Title of the Invention**

DEVICE FOR MEASURING THE MASS OF A FLOWING MEDIUM

Inventors (assignors)

| <i>Name</i> | <i>Address</i> |
|-----------------|---|
| Wolfgang MULLER | Renninger Str. 3/2, D-71277 Rutesheim, GERMANY |
| Klaus REYMANN | Robert-Koch-Str. 50, D-70839 Gerlingen, GERMANY |
| Uwe KONZELMANN | Schwalbenweg 14, D-71679 Asperg, GERMANY |
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Assignee

| <i>Name</i> | <i>Address</i> |
|-------------------|---|
| Robert Bosch GmbH | Postfach 30 02 20, D-70442 Stuttgart, GERMANY |

